British Journal of Environmental Sciences
Vol.10, No.6, pp.,73-84, 2022
Print ISSN: 2055-0219(Print)
Online ISSN: 2055-0227(online)

Ecological Status of Abasheba Demero Controlled Hunting Area: Implication for Conservation of Protected Area

[1]Tsigereda Cherenet
[1]Ecosystem Monitoring and Research Directorate, Ethiopian Wildlife Conservation Authority, Addis Ababa, Ethiopia

Citation: Cherenet T.(2022) Ecological Status of Abasheba Demero Controlled Hunting Area: Implication for Conservation of Protected Area, *British Journal of Environmental Sciences*, Vol.10, No.6, pp.,73-84

ABSTRACT: *Globally, the ecological status of protected areas has declined every year due to anthropogenic factors. This problem is also clearly observed in the Ethiopia control hunting area, although, there are no well- documented scientific studies. Therefore, the current study was conducted to determine land cover change, current wildlife status and their habitat utilization of selected wildlife in Abaseba Demero Controlled Hunting Area (ADCHA). Both lines transect and point count sampling methods was used to collect quantitative data on species. ERDAS 2015, Arc Gis10.3.1a, and SPSS version 23 were used for satellite image processing, map preparation to generate land use land cover change and for analyzed data respectively. The ADCHA has undergone changes in land cover and ecology. Forests and bush lands have been reduced by 16% and 4% respectively from the original state, while the agriculture land, bare land and built-up area have increased by 7%, 5%, and 7% compared to the original state in the past 19 years. According to the current study, 63 Mountain Nyalas, 42 Menelik's bushbucks and 3 Leopards were recorded in the study area. Those animals were more common in forest habitats and bush land. The relationship between land cover type and population distribution was ((n=199 df =40, p=0.000)), indicating a close relationship species and habitat types. Based on the above findings, the ecological status of the controlled hunting area was not immediately threatened, except for Menelik's bushbuck population trend. But man-made pressures are a serious problem that requires effective conservation measures.*

KEYWORDS: population status, land use land covers change, Abasheba Demero controlled hunting area, anthropogenic, threats

INTRODUCTION

As define by the International Union for the Conservation of Nature (IUCN), controlled hunting areas (CHAs) are research category IV protected areas. This area is also used for the ecological sustainability of wildlife (Kondratowicz *etal.*, 2011). The current status of the most protected area has declined globally (Muboko *etal*., 2016), due to human and natural factors (Brinker *etal*., 2007).

Human-induced landscape change is a major driver of species decline (Frescino *etal.*, 2001). There is a rapid change in land use/ land cover change and a drastic decline for a wide range of wildlife species (Murayama, 2009). As a result of this and other related factors, many African wildlife species are listed by the IUCN as threatened and at risk total extinction. (Estes *etal*., 2011). In addition, some studies suggest that well-managed and controlled hunting areas benefit wildlife populations to ensure their sustainability. When poorly managed and regulated, hunting areas often cause population losses (Roth and Merz, 1996). In other words, sport hunting activity in a controlled hunting area can support wildlife conservation and local development by generating huge revenue and it can ensure ecological sustainability through the application of strict hunting rules (Akito, 2012).

Regarding the ecological sustainability of trophy hunting, there are many debates and questions in most sub-Saharan African countries (Lindsey *etal*., 2016). Ethiopia is an ecologically diverse country and has a number of unique habitats due to wide existing latitude and altitude ranges and the characteristic fauna and flora with a high degree of endemic (EBI,2014).

Nevertheless, the challenges facing Ethiopian wildlife conservation today are becoming more and more formidable. Since agricultural productivity is generally very low, increasing food production depends on increasing the area under cultivation and grazing. Often, these expansions are at the expense of wildlife resources, resulting in the loss of both flora and fauna together with their habitats (Abunie, 2000). Ethiopia currently has 27 national parks, 2 wildlife sanctuaries, 6 wildlife sanctuaries, 25 CHAs, and five open hunting areas including five controlled hunting areas without an official lease. There are 54 huntable species and six safari hunting companies that exist in the country (EWCA, 2018). However, land use and land cover (LULC) dynamics is one of the most important visible changes that has occurred the Ethiopian landscape. These changes are seriously affect the ecosystem health; including the degradation of protected areas (Yohannes et al., 2017). However, there is data on land cover change, wildlife population trends, habitat status and utilization of wild animals in Abasheba Demero Controlled Hunting Area (ADCHA). Determining land cover change, wildlife population trend, status, and association with habitat is vital to demonstrate the ecological sustainability of the ADCHA so that the stakeholders will take necessary measures for the conservation action plan and monitoring program can be implemented in partnership with the local community, Federal and Regional organizations, Safari Hunting Companies and Safari Hunting Associations.

The main objective of the study was to determine the land cover change from 2000 to 2018, current status of wildlife population and habitat utilization of Mountain Nyala (Tragelaphus buxtoni), Menelik's Bushbuck (Tragelaphusscriptus meneliki) and leopard (Panther apardus) in ASDCHA.

MATERIALS AND METHODS

Description of the Study area and period

The study was conducted at the Abasheba Demero Controlled Hunting Area (ADCHA) from December 1/2018-September 30/2019. ASDCHA is located in the Bale zone, Oromiya Regional State, 485 km southeast of Addis Ababa via road Shashemene (Figure 1). Geographically, it is located between $6^0$29"- $7^0$15"N latitude and $40^0$10"- $40^0$45'' longitude. It has a total area of 210 km^2 (OFWE, 2018). The ASDCHA altitude ranges from 1178 to 3245 masl. It is characterized by rolling and steep hills interspersed with vast plains and small rivers. ASDCHA is mainly characterized by Afro-alpine forest consisting of indigenous trees (EWCA, 2015). This landscape heterogeneity leads to a diversity of habitats and thus a high wildlife biodiversity. The climate is relatively humid with an average annual rain fall of 750 mm to 1150 mm (Dadi *etal.* 2019). The average annual temperature varies from 5°C to 30°C in lowland areas and from 16°C to 20°C in the highland area (Mekonnin, 2013).

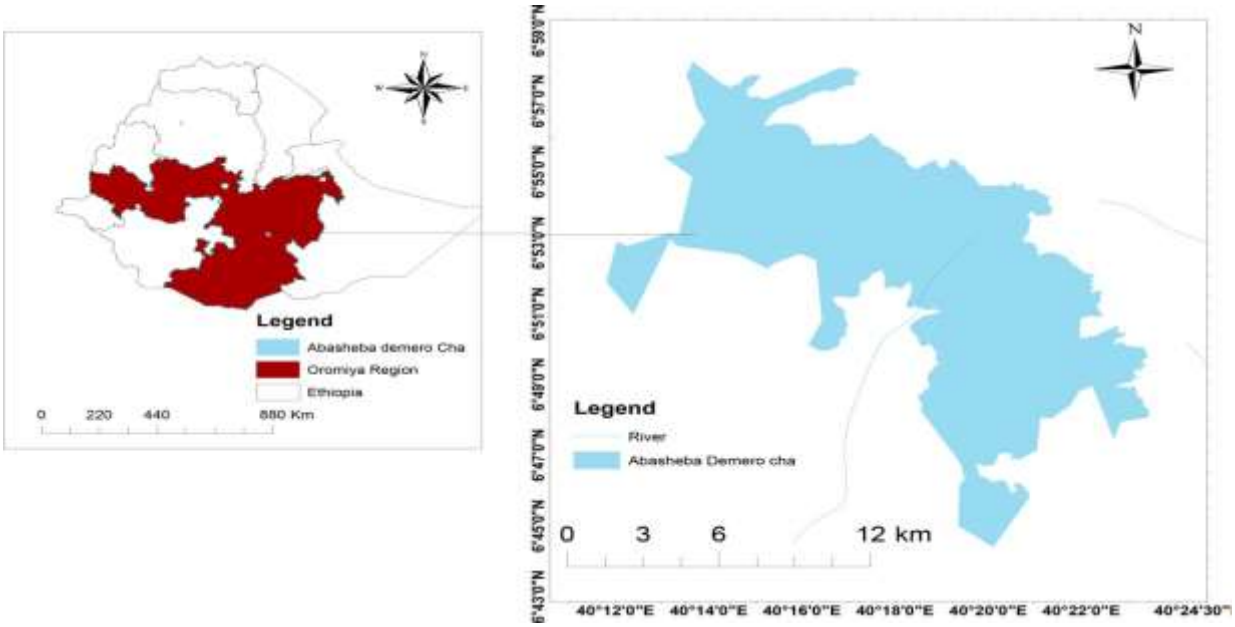

Figure 1: Location of Abasheba Demero controlled hunting area.

Study species
The studied species are Mountain Nyala (*Tragelaphus buxtoni*), Menelik's bushbuck (*Tragelaphuss meneliki*), Leopard (*Panthera pardus*) from ADCHA.

Sampling methods and procedure
Both line and point count transects methods were employed to determine wildlife population status (Buckland *et.al.*, 1993) and (WWF, 2004). The utility of using point counts to provide corrected population estimate for remote location is demonstrated by (Ralph *etal*., 1995a, Thompson, 2002). According to preliminary observations, the vegetation and topography of the area are not uniform. For the purpose of this study, following methods similar to Dadi *etal*.,(2019),the entire study area was stratified and applied random sampling design for the six major habitat types found during the study, namely forest area, bush: areas, agricultural land, grassland, built-up areas and bare land areas. Wildlife population estimation, structure and habitat utilization were examined using representative line transect random sampling design methods (Buckland *et al.,* 1993). A total 65 ground truths were made over the six identified sampling areas using GPS for the land use land change. The land cover change rate was estimated by calculating using formula (Kashaigili and Majaliwa, 2013). After classification, the comparison was used help to quantify the change of land cover over the period 2000 to 2018. This avoids the difficulties associated with analyzing image obtained at different times of the years. The number of transects established on the major habitat types were based on the total size of the habitat. The representative transects that pass each habitat were randomly selected in order to represent all of the major habitat types. Each transects in a given habitat were surveyed at the same time twice per day.

Source of data
To meet the objective of the study, primary data were collected from primary data sources. The primary data include satellite image, geographical coordination and population census.

Data collection methods
A total of 65 ground truths were performed across the six identified sampling areas; forest area, bush: areas, agricultural land, grassland, built-up areas and bare land areas for information on population size, demographic composition and predict habitat preference. Field survey times was early morning (6am to 10am) and late afternoon (3pm to 6pm), when animals were most active for feeding and maximum visibility of animals was possible. Data collection was performed by direct observation with the naked eye using binoculars. As pointed out by Wilson *etal*. (1996), direct observation technique is most appropriate for medium and large animals.

Data analysis
Data were analyzed using the classified satellite images ERDAS Imagine 2015 software, Arc Gis10.3.1. The data were analyzed by Statistical Package for the Social Sciences (SPSS) version 23.0. The association between the population of targeted species and land cover type were statistically analyzed using Chi-square test at p value < 0.05 levels.

RESULTS

The ADCHA underwent different LULCC between 2000 and 2018. Six land use and land cover categories were identified: forest, bush, grass, bare land, agriculture, and built-up area (Figure 2, 3, and 4). The present study showed that forests, bush land, grass land, bare land, agriculture, and built-up areas were the main land used and land cover types in the ADCHA. In 2000, the ADCHA mainly occupied by forest land (13035.48ha, 63.4%) followed by bush land and farmland (2722.23ha, 13.2%) and (2900 ha, 14.1%) respectively (Figure 2 and Table 1). In addition, grassland, bare land, and built-up areas accounted for the smallest share (644.697 ha, 3%), (414.744 ha, 2%), and (815.256ha, 3.9%) respectively (Table 1). In 2010, forest, bush land, and farmlands were the most dominant LULC types in the controlled hunting area with 6623ha (32.2%), 3722.23ha (18.1%), and 4300ha (20.9%), respectively (Figure 3 and Table 1).In 2018, the agricultural land, build up and bare land coverage increased to 4400ha (21.4%),2323ha (11.3%) and 1500ha (7,3%) respectively (Figure 4 and Table 1).

Table 1: Land use/cover area distribution from 2000 to 2018.

LULC	2000		2010		2018	
	Hectare(Ha)	Percentage (%)	Hectare(Ha)	Percentage (%)	Hectare(Ha)	Percentage (%)
Forest land	13035.48	63.4	6623	32.2	9600	46.7
Bush land	2722.23	13.2	3722.23	18.1	1900	9.2
Grassland	644.697	3.1	546	2.6	796	3.8
Bare land	414.744	2.0	3344	16.2	1500	7.3
Agricultural	2900	14.1	4300	20.9	4400	21.4
Built –up	815.256	3.9	2000	9.7	2323	11.3

Figure 2: Land use/cover map for ASDCHA 2000.

Figure 3: Land use/cover map for ASDCHA 2010.

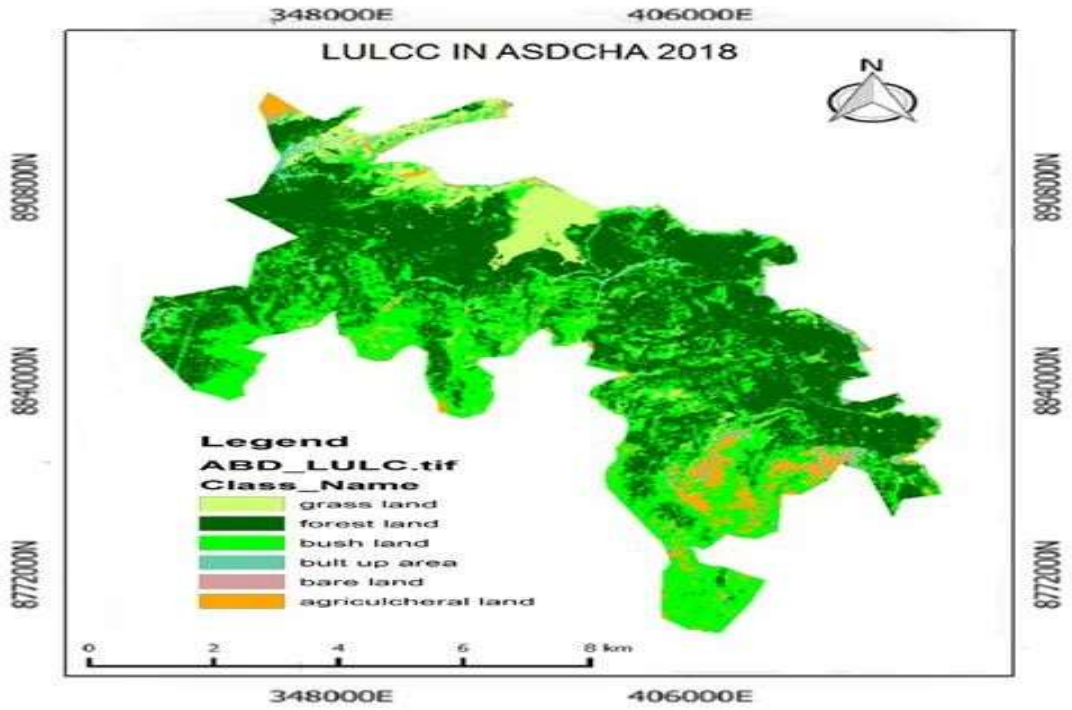

Figure 4: Land use/cover map for ASDCHA 2018.

During the 19 year period from 2000 to 2018, the compositions of LULCC were varying degree of changes. However, forest land decreased by -6412.4 ha (-31.2%) between 2000 and 2010, while it also increased by 2977ha (14.5%) from 2010 to 2018(Table 2). As shown in Table 2, the grassland decreased by -98.697ha (0.5%) from 2000 to 2010 and increased by 250ha (1.2%) from 2010 to 2018 (Table 2).

The bush land increased by 1000ha (4.9%) from 2000 to 2010 and decreased by 1822.2ha (8.9) from 2010 to 2018. Annual change in LULCC rates in bush land from 2000 to 2010 increased by 100ha and decreased by -202.47ha from 2010 to 2018 during the study period. In addition, agricultural land also increased by 1400ha (6.8%) from 2000 to 2010 and increased by 100 ha (0.5%) from 2010 to 2018(Table 2). In the period between 2000 and 2010 bare land cover increased by 2929.2ha (14.2%) and decreased by -1844 ha (8.9%) between 2010 and 2018 in the study area. From 2000 to 2010, the coverage of built-up area increased by 1184.7ha (5.8%) and decreased by 32ha (1.6%) from 2010 to 2018(Table 2).

Table 2: Land use land cover change from 2000 to 2018.

LULU	2000-2010			2010-2018		
	Area Change (Ha)	Percentage change (%	Annual Rate of Change (Ha/year)	Area change (Ha)	Percentage change (%	Annual Rate of Change (Ha/year)
Forest land	-6412.48	-31.2	-641.248	2977	14.5	330.7778
Bush land	1000	4.9	100	-1822.23	-8.9	-202.47
Grassland	-98.697	-0.5	-9.8697	250	1.2	27.77778
Bare land	2929.256	14.2	292.9256	-1844	-8.9	-204.889
Agricultural Land	1400	6.8	140	100	0.5	11.11111
Built–up area	1184.744	5.8	118.4744	323	1.6	35.88889

The present study showed that the highest number Mountain Nyala (47) were seen in the forest land and followed by Menelik's bushbuck (32) in the same area (Table 3). During the study period, the numbers of individuals observed in each habitat type were given in Table 3. The Mountain Nyala, Menelik's bushbuck, and Leopard showed more preference for forest and bush habitats respectively. As observed, forest and bush ecosystems were among the most important habitats used by two endemic species and one species used by CITES. There was significant association between the land cover type and number of wildlife population (df =40, p=0.000).

Table 3: Current population status and habitat utilization

Species	Mountain Nyala	Bushbuck, Menelik's	African Leopard
Forest Land	47	32	2
Bushland	11	6	
Grass Land	3	2	
Bare Land		2	
Farm Land	2		
Built-up area			1
Total observed	63	42	3

DISCUSSION

The Abasheba Demero Controlled Hunting Area is part of the Bale Mountains ecosystem, which is an important center of globally endemism, little is known about the population status of Mountain Nyala,

Menelik's bushbuck, and Leopard in Ethiopia. Although only a few studies have been conducted in different protected areas in the country, no scientific studies have been conducted at ADCHA on LULCC, population status, and the relationship of species to habitat. The land cover change analysis of ADCHA showed that the habitat has changed over the past 19 years.

The results showed that from 2000 to 2010, bush land, bare land, agricultural land, and built-up land increased respectively while forest land and grassland decreased. In the period from 2010 to 2018, the bush land and bare land has decreased. During the same period, forest land, grassland, agricultural land and built up area increased. This implies that the expansion of the agricultural land and built-up areas between 2000 and 2018 has reduced the forest, bush, and grassland. The increase in aerial coverage of the forest and grassland from 2010 to 2018 may be the reason for effective conservation action. Overall, this study is consistent with previous studies conducted in similar agro-ecological protected areas (Girma *etal*,.2019). Girma *etal.(2019)* reported that emission reductions from deforestation and forest degradation in the Bale Mountains eco-region from 2000 to 2015**.** Kidane *et al*.(2012) confirmed that the expansion of agricultural land in the Bale Mountains in the eco-region has increased at the expense of forest and grass LULC types, and to some extent, the conversion of the woodland LULC types dominated by Erica. According to Adane (2016) reporting, the expansion of agriculture/settlement expansion and reduction in woodland and forest area over the past 30 years in Bale Mountain National Park (SOS. 2013), this explained the rapid population growth led to expansion of agricultural land and settlements threatens high conservation values in the Bale Mountains eco-region.

Kiros *etal*.(2015) confirmed that the extent of land use cover dynamics conversion to new cropland in the central highland Ethiopia originated from bush land to agricultural land. The current population status of Mountain Nyala, Menelik's bushbuck, and Leopard during the study period at ASDCHA showed no significant differences from those reported by EWCA. However, greater numbers of Mountain Nyala, Menelik's, bush-back, and Leopard in forest habitats compared to other habitats were minimal.

This finding indicated that large herds of wildlife were observed in the natural and enhanced habitats of controlled hunting area. This finding is agreed with the study conducted earlier in similar habitats (Morrison *etal*., 1998). Forests and bush lands have the most suitable habitats and preferred species for the Mountain Nyala and Menelik's, bushbuck in Bale Mountains National Park (Yosef *etal.*, 2012a; Evangelista *etal.*, 2015).

CONCLUSION AND RECOMMENDATION

The controlled hunting area experienced notable changes in land use and land cover from 2000 to 2018. These changes have resulted in habitats alteration of Mountain Nyala, Menelik's bushbuck, and Leopard in ASDCHA. In addition, the decline of habitats such as forests and bush lands due to interchange with agriculture, bare land and built-up areas. The reduction in the total area of these

habitats poses challenges for the sustainable conservation of Mountain Nyala, Menelik's Bushbuck, and the African leopard. This means that the habitat of the species tends to decrease, directly affecting the ecological sustainability of the area and the target species. As a result, all the stakeholders work together to prevent and reduce problems encountered in controlled hunting, the species studied and their habitats are very promising for the future.

Conflict of Interest

The authors have no conflict of interest to declare.

Abbreviations

CHAE: Controlled Hunting Area of Ethiopia, ASDCHA: Abasheba Demero Controlled Hunting Area, LULCC: land use land cover change, EWCA: Ethiopian Wildlife Conservation Authority, BMER: Bale Mountains Eco-Region, CHA: Controlled hunting area, Ha: Hectare

Data sharing statement

Data is available upon request from the corresponding author.

Consent for publication

Not applicable

Acknowledgments

The author would like to thank the Ethiopian Wildlife Conservation Authority for funding the study. My special thanks and appreciation extend to the office members of Bale National Park for their cooperation and organizing the preconditions of data collection.

Authors' Contributions

The author made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and accountable for all aspects of the work.

Disclosure: This research did not acquire any specific grant from funding organizations in the public, commercial, or not-for-profit sectors.

Funding: The study was sponsored by the Ethiopian Wildlife Conservation Authority. The funders had no role in the study design, data collection, and analysis, decision to publish, and preparation of the manuscript.

References

1. Abunie,L. (2000). The challenges of conserving Ethiopian wildlife: Overview. *Walia.* **21**: 56-62.

2. Adane, M. N. (2016). Land use/land cover changes and associated driving forces in Bale. Eco-region, Ethiopia. MSc thesis Hawassa University, Wondo Genet.
3. Akito,Y. (2012). Is sport hunting a breakthrough wildlife conservation strategy for Africa? *Field Actions Science Reports* [Online], Vol. 6 |.
4. Brinker, D. F., Mc Cann, J. M., Williams, B., and Watts, B. D. (2007). Colonial nesting seabirds in the Chesapeake Bay region: where have we been and where are we going? Water birds. ***30*:**93-104.
5. Buckland, S. T., Anderson ,D. R., Burnham ,K. P., Laake, J. L., Borchers, D. L. and Thomas, L.(2001). Introduction to Distance Sampling: Estimating abundance of biological populations. Oxford University Press.
6. Buckland, S., Anderson, D., Burnham, K., and Laake, J. (1993). Distance sampling: estimating abundance of biological populations. Chapman and Hall, London.
7. Dadi, J., Demeke, D., and Dejene, W. (2019). Population Size and Habitat Utilization of Menelik's Bushbuck (Tragelaphus scriptus Meneliki Neumann, 1902) in Abasheba-Demero Controlled Hunting Area, Southeastern, Ethiopia. *Advances in Life Science and Technology*.***76.***
8. Estes, J. A., Terborgh,J., Brashares,j.S., Power,M.E., Berger,J., Bond,W.J.,Carpenter,S R., Essington, T.E., Holt,R.D., Jackson,.B., Marquis,R.J., Oksanen,L., Oksanen*T.,et al.*, Paine ,R., Pikitch,E., Ripple,W., Sandin,S., Scheffer,M., Schoener,T., Shurin,J., Sinclair,A., Soulé,M., Virtanen,R. and Wardle D.(2011)(2011).Trophic downgrading of planet Earth. Science 333, 301–306. doi:10.1126/ science.1205106; pmid: 21764740.
9. Ethiopian Wildlife Conservation Authority (EWCA). (2015).Annual Report, Addis Ababa, Ethiopia.
10. Ethiopian Wildlife Conservation Authority (EWCA). (2018).Annual Report, Addis Ababa, Ethiopia.
11. Evangelista, P., Young,N., Swift,D., and Wolde,A. (2015). Demographic Observations of Mountain Nyala Tragelaphus Buxtoni in a Controlled Hunting Area, Ethiopia. *Biodivers Endanger Species.* **3**(145).
12. SOS, F. (2013). Bale Mountains Eco-Region Reduction of Emission from Deforestation and Forest Degradation (REDD+) Project, Addis Ababa, Ethiopia.
13. Frescino, T. S., Edwards Jr, T. C., and Moisen, G. G. (2001). Modeling spatially explicit forest structural attributes using generalized additive models. *Journal of Vegetation Science.* ***12***(1):15-26.
14. Girma, A., Hussein, H. and Mersha, A. (2019). Land Use Land Cover Change Detection and Deforestation Modeling: In Delomena District of Bale Zone, Ethiopia Journal, Vol.10 No.4.
15. Kashaigili ,J.,J, and Majaliwa, A.,M.(2013). Implications of land use and land cover changes on hydrological regimes of the Malagarasi River, Tanzania. 2 (2013): 45-50.
16. Kidane, Y., Stahlmann, R. and Beirkuhnein, C.(2012). Vegetation dynamics, and land use and land cover change in the Bale Mountains, Ethiopia. Environ. Monit. Assess. 184, 7473 7489.
17. Kiros ,T. D., Desalegn, W. D ,Wakjira, D.T., D'Udine, F.,and Crawford, A.(2015). Migration and Conservation in Bale Mountains Ecosystem.*Availableonline: ecosystem- report.*
18. Kondratowicz, A. S., Lennemann, N. J., Sinn, P. L., Davey, R. A., Hunt, C. L., Moller-Tank, S., and Brindley, M. (2011). T-cell immunoglobulin and mucin domain 1 (TIM-1) is a receptor for

Zaire Ebola virus and Lake Victoria Marburgvirus. *Proceedings of the national academy of sciences.* ***108***(20): 8426-8431.
19. Lindsey, P, B. G., Funston, P., and Hunter, LT. (2016). Channeling global outrage in to funding for conservetion in Afirica: Life after Cecil.
20. Mekonnin, Z. (2013). Productivity of eucalyptus camaldulensis (Dehnh.) in GoroWeroda of Bale Zone, Ethiopia. *Journal of Agriculture and Environmental management*. **2**: 252-260.
21. Muboko, N. G. E., Muposhi, V.K., and Tarakini, T . (2016). Illegal hunting and protected areas: Tourist perceptions on wild animal poisoning in Hwange National Park, Zimbabwe. *Tourism Managemen.* 52-170.
22. Murayama, C. N. M. A. Y. (2009). Analysis of Land Use/Cover Changes and Animal Population. *Remote sensing.* Pp.968.
23. Ralph,C.J.,Sauer,J.R.,and Droege,S.(1995c).Preface. In Monitoring Bird Populations by Point Counts .USDA Forest Service General Technical Report. Pp.149.
24. Roth, H.H. and Merz, G. (1996) .Wildlife Resources. A Global Account of Economic Use. Springer-Verlag,New York, 402 pp in semi-arid area of Yechilay, northern Ethiopia .VL - 56. 10.1111/aje.12436.
25. Yohannes, H., Mohammed, A., and Elias, E. (2017). Land Use/Land Cover Dynamics and Its Impact on Biodiversity Resources in the Abijata Shalla National Park, Central Rift Valley Lakes Region, Ethiopia. *Environment Scince International Journal.* ***13***(5):152.
26. Yosef, M., Afework, B., and Girma, M. (2012a). Habitat use of mountain nyala(*Tragelaphus buxtoni*, Lyddeker, 1911) in the Bale Mountains National Park. *Ethiopia. International Journal Biodiversiversity. Conservation.***4**: 642– 651.
27. Wilson, D., Cole, F., Nichols, J., Rudran, R. and Foster, M. (1996). Measuring and Monitoring Biological Diversity. Standard Methods for Mammals.Smithsonian Institution Press, Washington, DC.